I. RING ENLARGEMENT BY REARRANGEMENT OF A β-CHLOROAMINE

II. AN EXPLORATION OF NEW ROUTES TO CYCLIC β-HYDROXY SULFIDES

BY

THEODORE MERRIAM VIAL

B.S., University of Maryland, 1942

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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ACKNOWLEDGMENT

The author wishes to express his gratitude to Professor Reynold C. Fuson for suggesting this study and for his advice and encouragement during the course of the investigation.

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PART ONE

RING ENLARGEMENT BY REARRANGEMENT OF A β-CHLOROAMINE

Introduction

In the course of war researches on the Levinstein mustard gas process it was found that treatment of certain 2-hydroxyisopropyl sulfides with hydrochloric acid or thionyl chloride results not in the expected 2-chloroisopropyl sulfide, but rather in a rearranged product, a 2-chloro-*n*-propyl sulfide. The rearrangement was presumed to occur through the intermediate formation of a cyclic sulfonium ion.[1] The nitrogen analogs, 1,2-dialkylaminochloropropanes, were found to undergo a similar rearrangement.[2] The reaction was used to bring about a ring expansion when 1-ethyl-2-chloromethylpyrrolidine rearranged to 1-ethyl-3-chloropiperidine upon liberation from its salt.[3] The present study was undertaken to find a means of preparing the next higher cyclic homolog, a 1-alkyl-2-chloromethylpiperidine hydrochloride and to determine its action upon treatment with base.

Discussion of Results

Ethyl picolinate was hydrogenated over Raney nickel catalyst to ethyl pipecolinate, which, in the presence of excess methanol as solvent, was reduced to the carbinol over copper-chromium oxide. The expected N-methylation did not occur, but instead the product of the reductions was 1-ethyl-2-hydroxymethylpiperidine. This was converted to the hydrochloride and then treated with thionyl chloride. The resultant 1-ethyl-2-chloromethylpiperidine hydrochloride gave a picrate which differed from that obtained from the free chloroamine after liberation by base and distillation of the extracted product. The picrate from the free amine was apparently a mixture of isomers, however. Upon reduction of the free chloroamine over palladium on charcoal there resulted a product which

was evidently a mixture of 1-ethyl-2-methylpiperidine and 1-ethylhexamethylenimine. A picrate from the reduction product melted over a wide range which could be changed by recrystallization, but the analytical values agreed closely with those calculated for the isomers. These facts indicate that upon liberation from its hydrochloride 1-ethyl-2-chloromethylpiperidine rearranges partially, resulting in a mixture with 1-ethyl-3-chlorohexamethylenimine. Evidence was obtained that this rearrangement occurs to some extent when the hydrochloride is merely dissolved in water.

As reference compounds 1-methyl- and 1-ethylhexamethylenimine were prepared by alkylation of ϵ-caprolactam, followed by hydrogenation over copper-chromium oxide.

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PART TWO

AN EXPLORATION OF NEW ROUTES TO CYCLIC β-HYDROXY SULFIDES

Introduction

The rearrangement of certain 2-hydroxyisopropyl sulfides upon treatment with hydrochloric acid or thionyl chloride[1] has been discussed in Part One of this thesis. The possibility exists

that the reaction might be employed to bring about ring expansion in a properly constituted cyclic β-hydroxy sulfide similar to the expansion exhibited by the analogous amines.[2] Consequently the present work was undertaken to study possible methods of preparing suitable β-hydroxy sulfides.

Discussion of Results

2-Thiophenecarboxylic acid was prepared from 2-acetylthiophene by oxidation with potassium permangante and hydrogen peroxide, the method of Voerman.[3] The same acid was obtained in better yields by the action of carbon dioxide on the Grignard reagent prepared from 2-halothiophenes according to the method of Schlenk and Ochs.[4] Sodium amalgam in dilute alkali was employed to reduce the acid to 2-tetrahydrothiophenecarboxylic acid. The crude saturated acid was converted to the ethyl ester by means of absolute ethanol and dry hydrogen chloride.[5] The reduction of the ester by sodium and alcohol was studied.

The diethyl acetal of 2-thiophenealdehyde was prepared by the method of Grishkevitch-Trokhimovskii[6] and a study made of its catalytic hydrogenation.

The preparation and characterization of *n*-propylthioacetaldehyde and its diethyl acetal were accomplished. These compounds were used as models in the studies on thiophenealdehyde and its acetal.

An investigation was made of the addition of hypobromous acid to 4-penten-1-ol using the methods of Hunter and Marriott[7] and of Read and Reid.[8] Products tentatively identified as 5-bromo-1,4-pentanediol and 4,5-dibromopentanol-1 were obtained.

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VITA

The author was born in Ware, Iowa, on February 27, 1921. He received his elementary education in the public schools of Pennsylvania and Illinois and was graduated from McKinley High School, Washington, D. C., in 1938. He then attended the University of Maryland where he received the degree of Bachelor of Science in 1942. After a tour of duty with the Army Air Force he entered the graduate school of the University of Illinois in 1945. He held a teaching assistantship the second semester of 1945-1946 and a University Fellowship during the academic year 1947-1948.

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